

**Subject Code: 01CH1301**
**Subject Name: Fluid Mechanics**
**B.Tech. Year: 2 (Semester III)**

**Objective:** This course deals with the study of fluid and its behaviour in various chemical processes and conditions.

**Credits Earned:** 4 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the fluid properties and their behaviour in static, kinematic and dynamic condition.
2. Understand the behaviour of fluid under the condition of submerged body.
3. Apply dimensional analysis to derive relationships among process or system variables.
4. Analyze the parameter to increase the efficiency of pumps and blowers.
5. Calculate the energy losses in pipe network system.

**Pre-requisite of course:** None.

### Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (I)	CSE (C)	Viva (V)	Term work (TW)	
3	0	2	4	50	30	20	25	25	150

### Contents:

Unit	Topics	Contact Hours
1	<b>Fluid Statics &amp; its application</b> Introduction to fluids, properties of fluids; density, specific weight, specific volume, specific gravity, viscosity, surface tension, Pressure Concept, Pascal's Law, Hydrostatic law of equilibrium, Pressure Measurement devices like Piezometer, U-tube Manometers, and Differential Manometer.	6
2	<b>Phenomenon of Fluid Flow &amp; Basic Equation of Fluid Flow</b> Kinematics of fluid flow: Types of fluid flow, Rate of flow, Continuity equation. Dynamics of fluid flow: Equation of motion, Euler's equation of motion, Bernoulli's equation, Practical application of Bernoulli's equation- Venturi meter, Orifice meter, Pitot tube.	8



3	<b>Flow of incompressible fluids &amp; Dimensional Analysis</b> Laminar flow in pipes, Hagen-Poiseuille equation, Friction in pipes, Effect of Roughness, Friction Factor Chart, equivalent diameter, hydraulic radius. Loss of energy in pipe- major and minor losses. Dimensional Analysis: Different methods of dimensional analysis applied to fluid flow problems, Dimensionless numbers.	10
4	<b>Transportation of Fluid:</b> Pumps– Positive Displacement Pumps, Centrifugal Pumps, Characteristics, Applications, Efficiency, Cavitation and NPSH, Fans, Blowers and Compressors: types and equations.	6
5	<b>Fluid Flow past Immersed Bodies</b> Drag force and drag coefficient, Flow through Beds of Solid (Packed bed), Kozeny- Carman equation, Burke-Plummer Equation, Fluidization- condition for Fluidization, Minimum Fluidization velocity, Types of Fluidizations, Applications of Fluidization.	6
	<b>Total Hours</b>	<b>38</b>

#### List of Experiments:

1. To study the flow behaviour using Reynolds's apparatus.
2. To study various pressure measurement devices.
3. To determine the viscosity of fluid by viscometer.
4. To study and verify Bernoulli's Theorem.
5. To determine the coefficient of discharge through venturi meter.
6. To determine the coefficient of discharge through orifice meter.
7. To study Rotameters and obtain its coefficient of discharge.
8. To measure the velocity of flow using Pitot tube.
9. Calculation of friction loss in pipe using water.
10. To determine the discharge coefficient for notches and weirs.

#### References:

1. "A Textbook of Fluid Mechanics", R. K. Bansal, Laxmi Publications Pvt. Limited, 2005.
2. "Unit Operations of Chemical Engineering", McCabe W L, Smith J C, Harriott P, McGraw Hill Publication, 7th edition 2005.
3. "Chemical Engineering" Vol. I – Fluid flow, Heat Transfer and Mass Transfer; Coulson & Richardson's, Butterworth – Heinemann Publication, 6th Edition.



4. "Fluid Mechanics for Chemical Engineers", Noel de Nevers, 2<sup>nd</sup> edition McGraw Hill Publication

### Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	30%	20%	20%	10%	-

### Instructional Method:

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

### Design Based Problems (DP)/ Open Ended project (OEP) :

In the beginning of the session, subject faculty will allot an OEP / DP to the students. Students will be free to choose a topic of their choice which will be relevant to the syllabus and they will either prepare a working model/ report / presentation / poster on their topic.

### Web Resources:

- a. <http://nptel.ac.in/courses/112105171/>
- b. <http://www.msubbu.in/ln/fm/>
- c. [http://www.engineeringtoolbox.com/fluid-mechanics-t\\_21.html](http://www.engineeringtoolbox.com/fluid-mechanics-t_21.html)